DOCUMENT RESUME

ED 445 839 RC 022 063

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TITLE Rural Telecommunications: Why Your Community Isn't Connected and What You Can Do about It. Staff Paper.
INSTITUTION Kentucky Univ., Lexington. TVA Rural Studies Program.
REPORT NO TVA-RS-SP-99-1
PUB DATE 1999-01-00
NOTE 12p.
AVAILABLE FROM Full text at Web site: http://www.rural.org/publications/Rowley99-1.pdf.
PUB TYPE Reports - Descriptive (141)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Computer Literacy; Free Enterprise System; Internet; Networks; *Public Policy; *Rural Areas; Rural Development; *Telecommunications
IDENTIFIERS *Access to Services; Access to Technology; Technology Utilization; *Telecommunications Infrastructure

ABSTRACT

Telecommunications technologies have great potential for linking rural homes, schools, businesses, and government. Experts agree that rural development depends on investment in additional telecommunications infrastructure and on local access to the Internet, but getting advanced telecommunications services to rural areas will take time. This report examines the obstacles to rural telecommunications access and ways to address them. Market obstacles include low rural demand for new telecommunications services, fewer large telecommunications users, fewer providers willing to serve rural markets, existing investments in rural infrastructure, and higher costs and technical complexity in rural areas. Regulatory obstacles include assumptions about the benefits of free market competition, lack of agreement about what constitutes "universal service," failure of regulations to differentiate between rural and urban conditions or between deployment and diffusion, and failure to tie telecommunications policy to economic development goals. Physical and technical obstacles include effects of distance and terrain on costs and service deterioration and the slow upgrading to digital switches in rural areas. End-user obstacles include the slower adoption of new technologies due to lower education and income among rural people. Local governments may try to counter these obstacles by using regulatory procedures or government purchasing power or by developing publicly owned infrastructure. Other community strategies for improving rural access include using rural area networks, interconnecting to urban networks, using wireless technologies, or working with alternative providers. (Contains references.) (SV)

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ED 445 839

Rural Telecommunications: Why Your Community Isn't Connected and What You Can Do About It

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January 1999

Staff Paper 99-1

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Tom Rowley is a freelance writer and research consultant under contract to TVA Rural Studies. The conference was jointly sponsored by TVA Rural Studies and USDA's Economic Research Service.

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Rural Telecommunications: Why Your Community Isn't Connected and What You Can Do About It

Telemedicine, distance learning, E-commerce, E-mail—the list of things that one can do with a computer and telephone line grows and astounds. The benefits of those activities, especially to small rural communities, are highly touted yet are neither completely understood nor quantified. Consequently, many an expert has heralded the information superhighway as the savior of towns, villages, and settlements far removed from the economic and social action of big cities, while others have cautioned that the technologies represent a threat as well as an opportunity. The 'highway' does, after all, run both ways—allowing business to come in, but at the same time allowing business to go out. Regardless, both parties—the optimistic as well as the cautious—agree: without access to advancing telecommunications technology, rural areas will be left even further behind.

Fortunately, some rural areas already have access. Take, for example, Lusk, Wyoming. Featured recently in a Microsoft television ad, this town of 1,504 in the least-populated county in the least-populated state has an upgraded communications infrastructure that links 600 homes, 2 schools, a hospital, a library, government offices, and businesses via 17 miles of hybrid fiber-coaxial cable.[1] Abingdon, Virginia nearby the Tennessee border in the Appalachian hills provides another example. This town of 8,000 is home to a 10-square-block fiber optic network that links businesses, schools, and government offices at data rates of 10 megabytes per second.[2]

While examples such as these are not unique, neither are they common. Even though some 94 percent of households in this country have basic phone service, only about a quarter has access to and uses the Internet. In rural areas, these numbers tend to be lower on average because of lower incomes, lower levels of education, lower quality of infrastructure, and higher costs of service. At a 1996 conference hosted by TVA Rural Studies and the Foundation for Rural Service, experts agreed on several key points about the status of the rural telecommunications infrastructure and the need for its improvement:

- **Investment in additional telecommunications infrastructure is essential for rural economic development.** While a considerable amount of infrastructure is now in place in rural areas, much of it is not capable of supporting advanced telecommunications services.
- **Local access to the Internet (the ability to go online without making a long distance call) is essential if rural areas are to avoid being left further behind.** Businesses, institutions, and citizens all need access to this source of information and commerce if they are to compete in the global economy. And the first step in making this and other advanced services possible is to ensure that local basic service has single-party, touch-tone lines; digital switching; and line quality sufficient for voice, fax, and data transmission at 28,800 bits per second.
- **Getting advanced telecommunications services to rural areas and having them adopted and used by rural areas will, however, take time—years in many cases.** While the estimates vary, the experts agree that rural areas—for a variety of reasons—will lag behind urban in gaining access to advanced services.[3]

The question raised by that last point is "Why?" What stands between many rural communities and their goals of being plugged-in, on-line, and connected? And more importantly, what can be done to remove those obstacles? This report attempts to answer those questions.

Obstacles

Cliché though it is, rural America is highly diverse. Communities differ along many dimensions—region, size, industry mix, institutions, and, of course, people. Consequently, the obstacles they face in gaining access to, and benefiting from, advanced telecommunications vary. What for some communities is a huge barrier, simply isn't a problem for others. In fact, some rural communities seem to have no barriers at all. What that means, of course, is that those communities worked hard and overcame their barriers. But first, they had to understand them.

What follows then is a discussion about the obstacles to advanced telecommunications that a rural community might face. Whether or not an obstacle is one that a particular community faces, only that community can determine. Furthermore, readers should not get caught up in the categories to which individual obstacles have been assigned. Clearly, the categories overlap and with a slight change of wording or emphasis, one obstacle could be made to fit nearly any category. The categories are meant only as a framework, a tool to help understanding.

Market Obstacles

The Telecommunications Act of 1996 drastically changes the determination of who gets what service, when, and at what price. Prior to the Act, governmental regulations and subsidies played the primary role. Following it, the market does. While reiterating the goal of universal service (albeit without defining it), the Act "charts a new course for achieving it"—a course that is consistent with a competitive market.[4] What then, are the implications for rural communities?

To begin with, in many rural areas there is—almost by definition—no "competitive market" for telecommunications services. That is, rural areas have, by definition, relatively few people and low population densities, and are at some distance from large cities. And each of these characteristics works against the existence of a competitive market.

First, there is relatively little demand for advanced telecommunications services in rural areas compared to urban. This is due in large part to the fact that there are relatively fewer people, industries and institutions in rural areas than in urban. For example, the 900 telephone companies that borrow from the Rural Utility Service (RUS)—and serve as a useful proxy for rural phone companies—average only 4 subscriber lines per square mile of area served and only 6 lines per route mile of telephone transmission plants. Large phone companies, on the other hand, average 10 times as many lines per mile.[5] Obviously, fewer users mean less demand.

It is also the case, however, that rural areas tend to have fewer large users of telecommunications. A handful of high-profile exceptions notwithstanding, communications-intensive industries tend to locate in more urban locations, not in rural. Fewer large users also means less demand.

On the supply side, rural areas also face hurdles. With relatively little demand in rural areas, most suppliers seek out higher-demand, and consequently more lucrative, urban markets. Thus, there are fewer providers willing to serve rural markets. This situation is made worse by the reduction if not elimination of cross-subsidies—compensation typically paid by urban users and providers to rural users and providers to offset the higher cost of service in rural areas.

Those providers that do serve rural areas are at risk of losing significant portions of their sales as large industries and institutions initiate their own in-house services. In such cases, the rural provider may be left only with the highest-cost, lowest-revenue portion of their current customer base, making continued service less than attractive for both the firm and its customers.

Another obstacle lies hidden in the existing investments in telecommunications

infrastructure in some rural areas—those that are the beneficiaries of relatively recent upgrades. For example, some rural telecommunications providers have only recently gone from analog to digital switching. The obstacle lies in the fact that while the areas served by these switches are in good shape for the short term, it will take time to recoup those investments and it will be very difficult to write them off when the next generation of switching technologies comes around. This, of course, would be true for an urban provider were it not for the ability to recoup investment faster in a larger, denser market.

Related to those investments is the issue of cost. Rural markets, on average, cost more to serve per user than do urban. Again, fewer users spread over longer distances is the main culprit. And those higher costs can, in turn, further reduce demand by pricing services out of reach. All of these factors can scare away potential suppliers, making the competition and lower prices promised by the Act less likely. If unchecked, a snowball effect can result, especially if low-cost rural customers are able to opt out of their current provider and find a new provider.

Finally, complexity seems to be an obstacle to some suppliers. A recent survey of rural telephone providers found that in addition to cost, technical problems and time were perceived to be major barriers to providing service. When asked what advice they would give to other rural providers contemplating providing Internet service, many said to not underestimate the cost and complexity.[6]

Regulatory Obstacles

In general, most experts agree that deregulation of the telecommunications industry does not bode well for rural areas. On the contrary, because deregulation tends to favor economic efficiency and profitability over issues of equity and universal service, many feel that it will lead to less access for most rural users. Furthermore, deregulation does not mean that the industry is completed unregulated. On the contrary, regulations continue to play a major role in determining whether rural areas have access to advanced telecommunications.

Many of the regulatory obstacles to advanced telecommunications in rural areas stem from problems with the definitions, assumptions, and concepts underlying the new regulatory regime. First and foremost, is the assumption that market competition will lead to adequate and appropriate telecommunications services in rural areas—an assumption called into question in the preceding section.

A second problem stems from lack of agreement on just what constitutes "universal service." Does such service include local access to the Internet for every citizen wanting it? Does it include broadband capacity to every community? Should it? Absent a more specific definition of universal service, it will be difficult indeed to ensure its existence.

Another source of regulatory hurdles is the failure of regulations to differentiate between urban and rural conditions. According to the Office of Technology Assessment's report, *Rural America at the Crossroads: Networking for the Future*:

> Conditions in rural areas are dramatically different from those in urban areas. This difference requires different telecommunications strategies. Regulatory policies must be designed to reflect these differences. Policies that pertain to lower Manhattan in New York City are not likely suitable to Aroostook County, Maine. Whereas Manhattan can sustain three competing telephone companies, Aroostook County barely sustains even one modern communications system. Rate-of-return regulation, depreciation policies, alternative regulatory frame-works, cable/telcom cross-ownership, telephone companies' entry into information services, and LATA boundaries and exchange boundaries require special treatment for rural areas.[7]

Consequently, some regulations have unintended consequences. For example,

discounts for telecommunications services are available to rural health care providers only if they are non-profit organizations. Unfortunately, many rural areas are served by a single physician or a small group practice—neither of which is a non-profit entity despite the likelihood that both are only marginally profitable. The result is to make rural health care even more difficult to maintain, much less to upgrade via telecommunications.[8]

Another source of obstacles lies in the distinction between deployment and diffusion. In the context of rural telecommunications, deployment refers to getting the infrastructure and services out to rural communities. Diffusion refers to the spread of their use, or their adoption. The adage of leading a horse to water comes to mind. Simply making telecommunications available will not ensure that they are used and therefore provide benefits. According to some researchers,

> ...the FCC procedures are much too narrowly conceived. Focusing primarily on the cost and market side of the picture, the FCC universal service rules treat the problem of diffusion as one of supply alone. Technology diffusion is not so simple, however. To the contrary, it is a highly complex and cumulative process that takes place over time and as a result of a wide range of social, economic, and political forces.[9]

Failure to account for these—as shown in the health care example above—can "result in rural communities being unable to take full advantage of advanced communication technologies, if—in fact—they use them at all."[10]

The failure to tie telecommunications policy and regulations to economic development efforts also leads to obstacles. According to the OTA report, "some State regulatory commissions are prohibited from considering anything but technology cost/benefits and may not include social costs and benefits. This makes it impossible to account for economic development goals in regulatory decisions."[11]

Finally, there are several smaller and more detailed, yet no less important regulatory obstacles. These include such things as:

- Long-distance boundaries—where they are drawn greatly affects rural users, who typically face long-distance tolls for many of the calls that are local and free to urban users.
- Taxes to pay for the Universal Service Fund—growing opposition to these may reduce the Fund's ability to provide assistance to rural areas.
- State and local regulations, such as allowable depreciation rates, building codes, rights-of-way usage, etc.—while often overlooked, these can hinder the provision and use of advanced telecommunications.

Physical/Technical Obstacles

With enough money, virtually anyone, anywhere can gain access to the latest advances in telecommunications. However, the amount of money necessary to overcome some of the obstacles discussed below is prohibitive for most individuals and most rural communities. Therefore, the obstacles remain in a real sense, physical and technical obstacles.

As has been said before, distance is a defining characteristic of many rural places. Consequently, infrastructure—whether roads, sewer pipe, or phone lines—must often cover long stretches of ground in order to serve the people who need it. In fact, the physical footprint of a typical rural telephone switch—the number of square miles served—is twice as large as a typical urban switch. (And even by covering all of that ground, the typical rural switch serves far fewer people.) Such distances mean two things: higher costs and service deterioration.[12]

The higher costs are self-evident. Copper, fiber, and cable all cost money. As do poles, trenches, and towers. The more you have to have, the more you have to spend. Service deterioration, although perhaps less obvious, follows right along. That is, the longer the line stretches, the weaker the signal becomes.

Consequently, problems result.

> When loops [the portion of the system that connects a user to the central office switch] exceed 18,000 feet, they require special treatment to maintain the quality of voice transmission. Loading coils are used, for example, to reduce voice frequency attenuation and range extenders are used to amplify a distant voice signal. But these treatments limit the usefulness of the line for data. Loading coils, which are present on about 40 percent of all rural subscriber loops, introduce delay distortion that limits data transmission to a few hundred bits per second. And range extenders may garble data, requiring retransmission.[13]

Thus, anyone further than 18,000 feet from a central office switch is basically unable to obtain many of the advanced services available today. (Unless they are willing and able to pay for a separate system.) Moving to broadband access, which allows more data to be sent at even faster speeds, reduces the maximum length of local loop even more to between 6,000 and 12,000 feet.[14]

To get an idea of how many rural communities face this obstacle, consider the following. Forty-five percent of the 900 RUS telephone companies have loop lengths of 18,000 feet or more. (The average for the 900 is 20,330 feet.) In contrast, 90 percent of Regional Bell Company loops are less than 18,000 feet.[15]

In a similar vein, the terrain that telecommunications lines must traverse can also increase the costs and length of time required to install them. Not surprisingly, water or hilly, rocky or otherwise rugged terrain is more difficult to cover than flat, dirt covered ground. In extreme cases, an altogether different type of transmission system is needed. For example, microwave radio is better suited and more cost effective in many situations where wireline service is not practical.[16] Likewise, truly remote subscribers (of which there are only about 183,000 in the United States or one percent of all rural subscribers)[17] may also be better served by wireless technologies. Note, however, that such options do not come cheaply. Despite the almost universal adoption of cellular telephones by the American public, there are large parts of rural America where there is no analog service and once you leave the major interstate highways, digital and PCS telephones do not work.

Distance and terrain aside, the type and quality of the switch serving those local loops is also very important. And with switches, the key word is digital. Digital switches permit the clear transmission of data and enable it to be sent faster, characteristics not possible in the earlier switch technology known as analog switches.[18] Not surprisingly given the expense of these switches and the fact that many rural areas only upgraded to analog switches in the 1980s, digital switches are slow in coming to rural areas. In fact, less than 10 percent of the U.S. network was digital in 1990, with larger, urban markets being served first.[19]

End-User Obstacles

As difficult as it will be to overcome some of the obstacles discussed above, getting advanced telecommunications to rural areas is only half the battle. The real victory lies in ensuring that the services are fully utilized by, and to the benefit of, rural businesses, citizens, and institutions. And several obstacles stand in the way of that.

First and foremost is the obvious Catch-22: People who lack advanced telecommunications services cannot utilize and benefit from them. People who have not utilized and benefited from them are less likely to demand them. People who do not demand them are not going to get them—certainly not from the market and perhaps not even from regulators.

Even in communities where advanced telecommunications are present, several characteristics of rural areas can hamper the adoption, use, and benefit of the services. In general, education, income, and age all influence the adoption of technology. The more education and income a person has, the more likely he or she is to adopt and use new technologies.

Likewise, youth helps. Consequently, rural areas with lower average levels of education and income and growing numbers of older people (due in part to out-migration of the young and better educated) tend to lag behind urban areas in the adoption and use of technology.

Obviously, low education, low income, and aging population are not uniquely rural characteristics. And, in fact, urban people with these characteristics also lag behind in technology adoption. But unlike urban people, rural people face still more hurdles to the use of advanced telecommunications:

- A rural resistance to the adoption of technologies and practices closely associated with the dominant urban culture.[20]
- A rural tendency toward economic conservatism stemming from an historical need to repair, reuse, and make do.
- Relatively fewer providers of technology training—whether educational institutions or telecommunications vendors.
- And finally as discussed in the section on market constraints, there are fewer people, fewer firms, and fewer institutions in rural areas and fewer that are large users of advanced telecommunications. Therefore, not only is demand thin, but familiarity is thin as well.

For rural people with disabilities, the hurdles multiply. Research shows that people with disabilities living in rural areas are disadvantaged relative to their urban counterparts.[21] And while definitions of 'disability' vary, "estimates consistently point to higher rates in rural areas."[22] Access to advanced telecommunications for the rural disabled cannot be taken for granted just because a community has obtained the services. For example, the lack of an elevator or an audio text device can still prevent someone in a wheelchair or someone without sight from using the services. Worse, evidence suggests that disabled people in rural areas may be less likely to express their needs for fear of "standing out" or "rocking the boat."[23]

In discussing the importance of taking into account the rural context when looking at the adoption of advanced telecommunications, Linda Garcia (Director of the original OTA study) and colleague Neal Gorenflo have this to say:

> To assure that advanced communication technologies and services operate to the benefit of rural communities, therefore, policymakers will need to concern themselves not only with the problem of deployment: they must at the same time try to create the optimal conditions for the productive use of these technologies.[24]

David Freshwater, program manager of TVA Rural Studies, puts an even finer point on it:

> ...in the case of advanced telecommunications services...the physical connection is only valuable if the individual who is connected has the skills to use the technology. Educating rural residents about the benefits of computers and helping them acquire the skills they need to benefit from the telecommunications revolution is a necessary part of providing the technology...If the end user does not have a computer or computer skills to access the telecommunications system or fails to appreciate the opportunities it offers, then all the telecommunications infrastructure in the world won't help.[25]

Overcoming the Obstacles

In spite of these obstacles, some rural areas have gained access to advanced telecommunications and are benefiting. The obstacles can be overcome. The approaches will, of course, vary greatly from community to community. What will not vary is the need for local citizens, businesses, and officials to come together and plan for their collective telecommunications future. Communities that fail to do so virtually ensure that they will be left behind in the ever-quickening race.

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That said, no one is suggesting that planning for rural telecommunications will be easy. Indeed, it will be quite difficult, for several reasons. First, technology is ever changing. How does one plan for that? Second, budgetary and other constraints limit the ability of small communities to conduct studies, hire consultants, and do much of the heavy technical lifting required in this type of effort. Third, local governments have relatively little regulatory jurisdiction over telecommunication, since most telecommunications systems are governed by international agreements and federal and state laws.[26]

Still, it can be done. Local governments do have several roles to play. A recent report from the International City/County Management Association describes those roles and the strategies that stem from them. The strategies include:

- **Doing nothing and hoping that the market provides the necessary services.** For many rural communities, this option will in all likelihood fail, for reasons discussed earlier.
- **Using regulatory and property management procedures to improve access to advanced telecommunications.** Franchise ordinances, lease agreements, and rights-of-way usage rules all offer opportunities to ensure that a community gets a better deal from providers.
- **Using government purchasing power to create a buyer's market.** The way government uses telecommunications, whether it uses an existing network or purchases a new one, whom the government purchases services from, what services it purchases, and how it purchases them all influence the quality, quantity, and cost of telecommunications services within a community. Careful consideration of each of those decisions is imperative.
- **Developing publicly owned infrastructure.** Sometimes, government may choose either out of necessity or opportunity to build its own infrastructure through a public-private partnership or a municipal utility. Again, great care should be taken when making those decisions.[27]

Likewise, participants in the OTA Follow-up conference discussed a number of approaches to improving rural access.[28]

- **Using Rural Area Networks (RANs).** Overcoming the lack of demand for advanced telecommunications is perhaps the single largest obstacle that rural areas face in a market environment. One researcher even goes so far as to say, "If demand exists, the infrastructure will be built to meet it. Adam Smith will see to that."[29] One way to generate that demand is to pool various users together and give them more leverage RANs, a concept proposed in the original OTA study, are

  > ...shared-usage networks, configured to include a wide range of users in rural communities. RANs would allow rural communities to pool their demand for advanced telecommunications services in order to justify and share the cost of sophisticated equipment that individual users could not otherwise afford or fully utilize. RANs would not be isolated 'technology islands,' but would connect rural areas with the rest of the world.[30]

  In addition to aggregating demand for advanced services and providing a way to pay for them, RANs also make life simpler for telecommunications providers by creating a single point of connection to the network rather than requiring connections to each individual user.

  Lusk, Wyoming and Abingdon, Virginia—the communities mentioned at the beginning of this report—are examples of Rural Area Networks. They connect multiple users—businesses, government offices, civic institutions, and private citizens—to a network and then connect

that network to the public network via a service provider. The result: residents of the communities are able to get advanced services that they might not have if they had not banded together.

- **Interconnecting to urban networks.** Another way to overcome obstacles is via interconnection with the urban portion of an existing network. This "piggybacking" eliminates the need to build duplicate infrastructure in rural areas and requires that a rural community pay only for the cost of extending the connection to the network. Unfortunately, the owners of the urban network—telephone companies—have little or no incentive to allow for interconnection, since it means the rural telephone company can then compete with them for business and profits and it takes away some of the capacity of their system to serve their own customers.
- **Using wireless technologies.** These technologies—such as microwave and radio—are particularly promising for rural areas, especially the most remote areas, since they eliminate the need for stretching miles and miles of wire or cable. Participants at the conference agreed that wireless will become the dominant technology for the most remote and lowest density telephone loops. There are some limits, however, since wireless is confined to voice, fax, and low-speed data transmission. In addition, the technology is quite expensive, requiring towers and satellites.
- **Working with alternative providers.** Large telephone companies, including the Regional Bells are unlikely, according to conference participants and other experts, to provide rural America with the services it needs, especially in a deregulated environment. They simply do not have the incentives. Instead, smaller phone companies, electric utilities, cable television companies, and even municipalities themselves are often in the best position to ensure that their communities get what they need. In fact, may rural telephone exchanges have been sold by Regional Bells and GTE to smaller, independent companies and in most cases the facilities and services were upgraded and improved.[11]

Conclusion

In spite of the many obstacles facing rural communities, there are ways for them to gain access to advanced telecommunications. The methods will, of course, vary, but the need for local planning and involvement will not, nor will the need for training and education. Without the former, any efforts are likely to be misinformed, misguided, and miss the boat. Without the latter, all the rest is for naught. All the nifty technology in the world won't improve the lives of rural people, if they can't or won't use it. You can lead a horse to water...

Notes

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